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Machine learning inspired analysis of the Ising model transition

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We illustrate how principal component analysis of simulation data represented as images generated from the worm algorithm, a method to sample the strong coupling contributions, can be used to identify the critical temperature Tc in the Ising model. It is shown that the eigenvalue corresponding to the first principal component of the covariance matrix obtained from pixel ensembles scales logarithmically as one approaches Tc, in a way that is similar to the specific heat. We then illustrate how to block the resulting worm configurations under renormalization group transformations. It is found that curves for the variance of the average number of bonds can be scaled appropriately to illustrate universal behavior under the renormalization group transformation, and that discrepancies can be understood as an effect of approximations.

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